Emotional Regulation System for Emotionally Adapted Games

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Abstract

The paper presents an approach to build emotionally adapted games based on a user-controlled emotional regulation system. Underlying the approach is a Psychological Customization system. It entails personalization of the way of presenting information (user interface, visual layouts, modalities, narrative and temporal structures and other factors) per user or user group to create desired transient psychological effects and states, such as emotion, attention, involvement, presence, persuasion and learning.

1. Introduction

Emotions as part of user experience of gaming are biologically based action dispositions that play an important role in the determination of behavior (e.g., Lang, 1995). Most theorists endorse the view that emotions comprise three components: subjective feeling, expressive behavior, and physiological arousal; others add motivational state or action tendency and/or cognitive processing (Scherer, 1993). Theorists differ over a discrete versus a dimensional emotion model. Some theorists emphasize basic discrete emotions, such as anger, fear, sadness, happiness, disgust, and surprise (e.g., Ekman, 1992). According to them, these emotions are unique experiential states that stem from distinct causes, are present from birth, and have distinct adaptive value. In contrast, a dimensional theory of emotion holds that emotions are fundamentally similar in most respects, and all emotions can be located in a two-dimensional space, as coordinates of valence and arousal (or bodily activation; e.g., P.J. Lang, 1995; Larsen & Diener, 1992). The valence dimension refers to the hedonic quality or pleasantness of an affective experience, and ranges from unpleasant to pleasant. The arousal dimension indicates the level of activation associated with the emotional experience, and ranges from very excited or energized at one extreme to very calm or sleepy at the other.

2. System Design, Methods and Empirical Results

2.1 Psychological Customization

A useful concept for emotional gaming is Mind-Based Technologies (Saari, 2001). Mind-Based Technology takes into account individual differences in processing information in order to be able to offer a particular user a particular type of experience. This type of system design approach may be of practical use, as it is known that individual differences in processing information may produce sometimes quite large variance in the intensity or type of psychological effects, such as depth of learning, positive emotion, persuasion, presence, social presence and other types of psychological states and effects (Saari, 2001; Saari, 2002; Saari, 2003a; Saari, 2003b; Saari, 2004; Saari et al, 2004; Saari et al, 2005a; Saari et al, 2005b).
Psychological Customization is one possible operationalization of Mind-Based Technologies in system design. It can be applied to various areas of HCI, such as Augmentation Systems (augmented and contextualized financial news), Notification Systems (alerts that mobilize a suitable amount of attention per task or context of use), Affective Computing (emotionally adapted games), Collaborative Filtering (group-focused information presentation), Persuasive Technology (advertising for persuasion, e-commerce persuasion), Computer Mediated Social Interaction Systems (collaborative work, social content creation templates), Context sensitive computing (adaptation of information per context and situation) and Messaging Systems (emotionally adapted mobile multimedia messaging and email). (Saari and Turpeinen, 2004a; Saari et al, 2005c)
Psychological Customization System is a new form of middleware between applications, services, content management systems and databases. It provides an interface for designing desired psychological effects and user experiences for individual users or user groups. The most popular framework for building customized Web-based applications is a three-tiered architecture, such as Java 2 Enterprise Edition (J2EE). The implementation of

the Psychological Customization System for Web-based applications is depicted in Figure 1. The basic J2EE three-tiered architecture consisting of databases, application servers, and presentation servers has been extended with three middleware layers: content management layer, customer relationship management layer, and psychological customization layer. The profiles of the users and the communities are available in the profile repository. The Content Management System is used to define and manage the content repositories. This is typically based on metadata descriptions of the content assets. The metadata of the content repositories is matched against the user and community profiles by the Customer Relationship Management (CRM) system. The CRM system includes tools for managing the logic behind content, application and service customization. Rules can be simple matching rules or more complex rule sets. A special case of a rule set are scenarios, which are rule sets involving sequences of the interactions on the Web site. The Customer Relationship Management layer also includes functionality for user and community modeling. This layer can also perform automated customer data analysis, such as user clustering. (e.g. Turpeinen and Saari, 2004a)

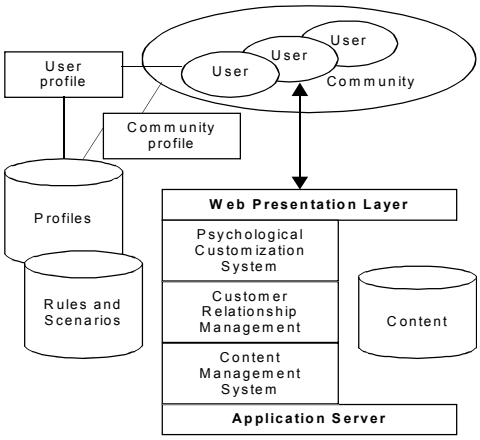

Figure 1. J2EE implementation of the Psychological Customization System (adapted from Turpeinen and Saari, 2004)

The Psychological Customization System layer performs the optimization of the form of the content as selected by the Customer Relationship Management layer. This functionality can be considered similar to the device adaptation by using content transformation rules (for example XSL-T). In the case of the psychological customization, the transformation rules are produced based on the design rules for content presentation variation and the contents of the psychological profile of the user. After this optimization, the content is passed to the Web presentation layer. One can also add various sensors in the model extracting the state of the environment and users. Technologies such as eye-tracking, video capture of situations and contexts, microphones and psychophysiological recording can be used. Naturally, if these signals can be captured in a non-intrusive manner it would be optimal.

2.2 Psychophysiological Measurement

Psychophysiology is a very promising method for verifying emotional states and effects during gameplay. A large number of studies have shown that tasks requiring cognitive effort or active coping elicit emotional arousal and sympathetic nervous system (SNS) activation as indicated by an increase in heart rate (HR; i.e., a decrease in cardiac interbeat intervals, IBIs; Ravaja, 2004). For example, studies on psychophysiological reactivity to stress have shown that different video games (i.e, an active coping task) prompt notable increases in HR and blood pressure (e.g., Johnston, Anastasiades, & Wood, 1990; Matthews & Jennings, 1984; Murphy, Stoney, Alpert, & Walker, 1995). It has also been found that violent video game play elicits greater arousal as indexed by HR and systolic blood pressure compared to a nonviolent game (Calvert & Tan, 1994; Fleming & Rickwood, 2001), although this effect has not been present in all studies (e.g., Irwin & Gross, 1995; Winkel, Novak, & Hopson, 1987). When interpreting HR responses, it should be recognized, however, that the heart is dually innervated by both the SNS and parasympathetic nervous system (PNS; Ravaja, 2004). Therefore, HR carries information on both sympathetic and parasympathetic activity, which may entail interpretative difficulties. Increased cardiac sympathetic activity is related to emotional arousal and causes the heart to speed up, whereas increased cardiac parasympathetic activity is related to information intake and attentional engagement and causes the heart to slow down (Turpin, 1986). Given that video game play may elicit both emotional arousal and attentional engagement, HR may not be an optimal measure of arousal in this connection (Ravaja et al, 2005).

Electrodermal activity (EDA; or skin conductance) has also frequently been used as a measure of arousal. The advantage of EDA is that it is interpretatively unambiguous, given that it is innervated entirely by the SNS (Dawson, Schell, & Filion, 2000). When emotional arousal increases, the accompanying activation of the SNS results in increased sweat gland activity and skin conductance. The validity of EDA as a measure of emotional arousal has been established in studies showing that EDA varies linearly with self-reported arousal when viewing emotional pictures, for example (e.g., Lang, Greenwald, Bradley, & Hamm, 1993). Bersak et al. (2001) have also recently developed a therapeutic game called Relax-to-Win where the player's level of arousal as indexed by EDA controls the speed of a racing dragon, an increase in arousal resulting in a decrease in the dragon's pace (the player who relaxes more quickly wins the race).

Facial electromyography (EMG) provides a direct measure of the electrical activity associated with the facial muscle contractions related to emotional expression (Ravaja, 2004). The facial EMG is an established index of hedonic valence; that is, increased activity over corrugator supercilii, which draws the brow down and together into a frown, is associated with negative emotions, whereas increased activity over zygomaticus major, which pulls the corners of the mouth back and up into a smile, is associated with positive emotions during affective imagery and when viewing pictures (for 6 s) or other media stimuli (e.g., Lang et al., 1993; Ravaja, Kallinen, Saari, & Keltikangas-Järvinen, 2004; Witvliet & Vrana, 1995). In addition, increased activity at the orbicularis oculi (periocular) muscle area has been associated

with both positive and high-arousal emotions during affective imagery and media viewing (Ravaja, 2004; Ravaja, Saari, Kallinen, & Laarni, 2004). Unfortunately, prior game studies have not used psychophysiological measures of emotional valence, such as facial EMG.

In our own research we have extensively used psychhophysiological measures to validate emotions during gaming experiences. In video games, there is a dynamic flow of events and action, games potentially eliciting a multitude of different emotions varying across time. A serious limitation of prior game studies is that they have used tonic, rather than phasic, psychophysiological measures. Tonic measures (e.g., the mean physiological value during the game minus pre-game baseline) do not enable the examination of the varying emotions elicited by different instantaneous game events. Given that psychophysiological measurements can be performed continuously with a high temporal resolution, it is possible to quantify phasic responses to instantaneous game events (e.g., by comparing the local pre-event baseline to physiological activity immediately following event onset). (Ravaja et al, 2005)

2.3 Experimental Evidence

Even though no actual system has been implemented yet for Psychological Customization related to gaming, empirical evidence found in literature supports the feasibility and validity of this idea: i) there are individual differences in cognitive processes such as attention, memory and language abilities and this has a considerable effect on computer-based performance (e.g. Egan, 1988); ii) individual differences in memory capacity have an effect on people's behavior in many types of activities (Vecchi et al, 2001); iii) different modalities, such as visual and auditory, may lead to different kinds of psychological influences and the valence of a preceding subliminal stimulus influences the subsequent evaluation of a person evaluated (Cuperfain and Clarke, 1985; Krosnick et al, 1992); iv) different ways of processing information influence learning and emotion of stimuli with certain modality (Riding and Rayner, 1998); v) emotional information increases the user's self-reported emotion (Lang et al, 1996); attention (physiological and self-reported) (Lang et al, 1995) and memory for mediated messages, particularly arousing messages (Lang, 1990; Lang et al, 1995; Lang et al, 1996) and vi) recognition and memory can be influenced or even enhanced by previous exposure to subliminal visual or auditory images of which the subjects are not consciously aware (Kihlström et al, 1992). Some of these effects are produced in interaction with individual differences, such as cognitive style, personality, age and gender.

Our own research on the influence of form factors of information presented on colour screen PDA´s and mobile phones (such as news, games, messaging content and entertainment content) on psychological effects has yielded many results. Typical experiments we have conducted on the influence of form of information on psychological effects have included such manipulations as animation and movement (for orienting response), fonts of text, layout of text, skin texture, background colors of text, user interface navigation element shapes (round vs. sharp), user interface layout directions, adding background music to reading text, use of subliminal affective priming in the user interface (emotionally loaded faces) and use of different modalities of information, for instance. We have used various methods, such as i) psychophysiological signals (electroencephalography [EEG], facial electromyography [EMG], electrodermal activity [EDA], cardiovascular activity, other), ii) eye-based measures (eye blinks, pupil dilation, eye movements) and iii) behavioural measures (response speed, response quality, voice pitch analysis etc.). Naturally, methods similar to ours can be used to create rule-databases to act as basis of Psychological Customization (For a review of psychophysiological methods see Ravaja, 2004b).

Results include for instance the following: i) subliminal exposure to happy affective primes in connection with video messages presented on a small screen has several putatively positive influences (i.e., increased pleasure, perceived message trustworthiness, and memory) (Ravaja, Kallinen, Saari, & Keltikangas-Järvinen, 2004); ii) media messages can be modified in terms of audio characteristics (Kallinen and Ravaja, 2004; Ravaja and Kallinen, 2004) and the presence of image motion (Ravaja, 2004a) to meet the personality (as defined in terms of dispositional behavioral activation system sensitivity) of the user, thereby enhancing his or her attentional engagement, information processing, and enjoyment; iii) there are personality-related differences in people's aesthetic and emotional evaluations of different aspects (e.g., color, skin texture) of visual design (Laarni et al., in press; Laarni et al, 2004 a; Laarni et al, 2004b) and iv) user-changeable covers of mobile devices may also influence the emerging psychological effects (e.g. Laarni and Kojo, 2001).

3. Emotionally Adapted Games

3.1 Gaming Templates and Emotion

Apparently, emotions or emotion-related variables (e.g., competitiveness) play a critical role also in gaming behavior (Grodal, 2000; Vorderer, Hartmann, & Klimmt, 2003). People seek, and are eager to pay for, games that elicit positive emotional experiences and enjoyment; however, an enjoyable game may not elicit only positive emotions but possibly also negative ones (e.g., anger, fear). Thus, one of the major goals for video game designers is to elicit optimal emotional responses or response patterns. Prior psychological game studies have focused on negatively valenced emotions elicited by video games in trying to unravel their potential adverse effects. Ballard and Weist (1996) and Anderson and Dill (2000) found that a violent video game elicited hostile affect, while three other studies showed virtually no effect (Nelson & Carlson, 1985; Scott, 1995; Calvert & Tan, 1994).

How then to link emotions in games and basic elements of games? One obvious answer is to look at the narrative element in games in which the other possible emotionally significant elements of games reside. In fact, games have often been researched from the point of view of narrative, consisting of a dramaturgical structure focused on crisis and the resolution (Meyer, 1995). However, it may be that gaming is not easily understood as a linear narrative. For instance, a gamer may be more interested in collecting points and more powers for his

character inside the game and mere survival between different levels of the game than in moving along a story line coherently towards a climax (Lankoski, 2003).

Similarly, it has been argued that the participatory aspect of gaming is the key to the experience of gaming (Darley, 2000). It may be stated that the algorithm of the game is another key source of experiencing a game (Manovich, 2001). This implies that as the player learns the hidden rules and logic behind the game and is therefore successful in playing it, a state of satisfaction may arise. Further, it is evident that the skills of the gamer vs. the challenges presented in the game should be in balance (Järvinen et al, 2002). If a game is too difficult or too easy to play, it may not be involving, but rather frustrating or boring. Another difference between narrative and games is that the tensions in narrative are dependent on the irreversibility of the consequences of the events of the narrative (Poole, 2000).

Despite the differences between traditional narratives and games, many similarities exist. One way to look at this is to observe the narrative schema as a basic way of organizing memories (see Mandler, 1984). A narrative schema in storytelling may have the following structure: i) introduction of a setting and key characters, ii) explanation of the current state of affairs or the situation at hand, iii) initiating event leading to a motivation to act or change the state of affairs, iv) emotional response of the protagonist and a goal for acting or changing the state of affairs, v) the difficulty experienced by the protagonist while performing actions to change the state of affairs and vi) the outcome of the action of the protagonist, i.e. success or failure in changing the state of affairs (Branigan, 1992). This implies that i) the role of the characters in the game is of key importance, including the role and point of view of the player and his character or role and ii) it is possible to create emotional reactions and motivation in the player to act in a desired manner by introducing events in a certain manner, or by offering a chance to succeed in attaining a goal. Hence, from the point of view of emotions, manipulating the events within a particular sequence of the game as well as introducing the situation and creating basic tensions and motivations as a basis for the task of the user in the game are important.

Outside narrative elements of a game, also the factors related to the presentation of the substance of the game or the form of the game, such as visual representations of the gaming events, amount and pace of image motion, audio effects and background music, and the level of interactivity offered to the player, are important from the point of view of emotion. (Saari et al, 2005a; Saari et al, 2005b)

A basic approach to an element to be adapted inside a game is a psychologically validated template that is embedded inside the game to create a particular psychological effect. A broad view of templates may be that the whole game consists of a database of psychologically validated templates that are presented in sequences. A limited view entails that a smaller collection of templates is used. The element of psychological evaluation means that the selected psychological influence (such an emotional response) of the template on a particular type of user is sufficiently well predictable. These psychologically evaluated templates may consist of i) manipulating the substance of a game, such as story line (initiating events, new characters etc.) and manipulating the situations specifically related to the character of the player (such as putting the character into sudden and dangerous situations inside the game) and ii) manipulating the form or way of presentation of the game (such as visual elements, shapes, colours, types of objects, sound effects, background music, level of interactivity and feedback etc.). The difficulty level of the game may also be continuously automatically be adjusted, thereby keeping the skills and challenges in balance, which results in a maintenance of an optimal emotional experience and possibly also a flow-state. (Saari et al, 2004)

The possibilities for manipulating the form of the game inside the narrative are presented in Table 1.

Table 1. Technological possibilities of Psychological Customization in emotionally adapted gaming. Adapted from Saari et al, 2004

Layer of Technology	**Emotionally Adapted Gaming Templates**
1. Physical	-Mobile device: user changeable covers in colours and shapes that facilitate desired emotion -PC: colours and shapes that facilitate desired emotions
2. Code *-Windows-type user interface* *-Mouse, pen, speech,*	-The user interface elements (background color, forms, shapes, directions of navigation buttons etc.) may be varied in real-time per page per user to create various emotions and ease of perceptual processing -audio channel may be used to create emotional effects (using audio input/output sound, varying pitch, tone, background music, audio effects etc.) -the interaction modalities may be adapted to suit the nature of the task
3. Content **A. Substance** *- Multimedia content created by authors or generated by game algorhithms*	-The genre of the game or type of game should be taken into account (first person shooter, simulation game, level playing game, other) -Emotionally engaging story lines and events may be used to facilitate certain emotions -The role of the user in the story can be varied to create emotional reactions -Adding subliminal extra content to create desired emotion while playing
B. Form **Modality** *-Multimedia*	-Modality may be matched to cognitive style or pre-existing mood of the receiver to create ease of processing -Background music, audio effects or ringing tones may be used as a separate modality to facilitate desired emotions and moods
Visual presentation	-Emotionally evaluated and positioned layout designs and templates for (colors, shapes and textures) may be utilized per type of user segment
Structure -linear/non-linear	-Using emotionally evaluated and positioned narrative templates for creating emotionally engaging story structures and varying sub-elements of the narrative and form within the template to create different emotional emphasis of the events unfolding (related to substance of content) -Using different temporal resolutions, such as fast or slow pace of events that may influence arousal

3.2 Emotional Regulation Space

In Table 2 the emotional possibilities of emotional regulation are summarized.

Table 2. A dimensional approach to emotionally regulated gaming. Adapted from Saari et al, 2005.

	Low arousal	**Neutral arousal**	**High arousal**
Valence	***Relaxation, calmness*** +Relaxation and concentration games with peaceful atmosphere or so +Short break in an adventure game, after having achieved a goal, a "break to breathe" and experience some reward -No use in aggressive games	***Happiness, satisfaction*** +When reaching a goal in a game this is elementary and can be motivating to play the game further -Perhaps not feasible	***Energetic, peppy, joyfulness, enthustiasim*** +Important in many games , related to success in the game or one´s gaming skills, a motivating factor to play further +Can indicate a successful gaming session -Perhaps not feasible
Neutral valence	***Inactivity, idleness, passivity*** +Perhaps not feasible, unless the goal of the game is too passivate the person -Perhaps should be avoided in most games	***Totally neutral experience*** +Not very feasible -Not very feasible	***Arousal, alertness, excitation*** +In many games the gaming challenge and events could lead to this +One could also maximize arousal in driving games, adventures or violent games if one wishes -Arousal management
Negative valence	***Tiredness, boredom, dullness, helplessness*** +Perhaps not feasible -Perhaps should be avoided in most games as these may be indicators of poor gaming skills vs. the challenge of the game, a boring game or some other fundamentally distracting factors to the gaming experience	***Sadness, dissatisfaction, disappointment*** +These are basic parts of experience in many games, for instance, when not succeeding to reach a goal or so -May indicate poor gaming skills	***Anger, aggression, fear, anxiousness*** +In many games this is a basic part of experience in the game +One could also maximize aggression in a game -Totally avoiding or controlling aggression in a game, for instance for children or those wishing to have a less aggressive gaming experience

First, there are the transient basic emotional effects of games that are dependent of the phase of the game or some specific events. These are emotions such as happiness, satisfaction, sadness, dissatisfaction, anger, aggression, fear and anxiousness. These emotions are the basis of narrative experiences, i.e. being afraid of the enemy in a shooting game, feeling aggression and wishing to destroy the enemy and feeling satisfaction, even happiness, when the enemy has been destroyed. Emotional regulation systems in these instances most naturally may focus on manipulating the event structures, such as characters, their roles, events that take place and other features of the narrative gaming experience. (Saari et al, 2005a; Saari et al, 2005b)

Second, there are possibilities for emotional management, especially in the case of managing arousal, alertness and excitation. Also, one may wish to manage negative emotions, such as sadness, dissatisfaction, disappointment, anger, aggression, fear and anxiousness. The case for managing these emotions is twofold. On the one hand, one may see that these emotions could be eliminated altogether in the gaming experience. This can happen via either eliminating, if possible, the emergence of such an emotion in the game. For example, making a deliberately happy game with level-playing monkeys in a far away island throwing barrels at obstacles and gathering points. This would include minimum negative emotions. Or, in a game where negative emotion is a basic part of the game, one may wish to limit the intensity of the emotions via manipulating gaming events and gaming elements so that sadness or fear are at their minimum levels, or that gaming events do not lead to sadness at all. (Saari et al, 2005a; Saari et al, 2005b)

Similarly, managing level of arousal or the intensity of negative emotions may be quite feasible in the case of children as a form of parental control. On the other hand, one may wish to maximize arousal, alertness and excitation, perhaps even anger, fear and aggression for hardcore gamers.

Third, in Table 2 there are possibilities related to the avoidance of certain types of emotions that are typically indicative of a poor gaming experience. Inactivity, idleness, passivity, tiredness, boredom, dullness, helplessness as well as a totally neutral experience may be indicating that there is some fundamental problem in the user-game interaction. This could be due to poor gaming skills of the user vs. the difficult challenges of the game or some other factors, such as the user is stuck in an adventure game for too long and can not proceed without finding a magic key to enter the next level or so. When a gaming engine detects these emotions in the user, it may adapt its behavior to offer the user more choices of selecting the difficulty level of the game or offer the user some clues as to how to go forward in the game. The game can also adapt its level of difficulty to the player´s skill level. (Saari et al, 2005a)

Based on these three main clusters of emotional regulation in games we state that the possibilities of emotional gaming relate mainly to i) controlling the intensity of different emotions in the dimensional model of emotional experience (valence-arousal) and ii) eliminating, if possible, some emotions altogether from the game. Out of these the first approach may be more relevant, as it may be that eliminating basic emotions in gaming experiences may be overly difficult, unless one really focuses on creating an overly happy game or an overly aggressive and negative game. However, the elimination or minimization of certain emotions may be feasible in the case of indicated overly

poor gaming experience in which the game may adapt its behavior to advice and help the user. It should be noted that events in games may change quickly and produce complex situations and hence complex emotions that may change rapidly. Consequently, one should better integrate these approaches into the genre or type of the game, such as driving simulator, first person shooter, sports game such as golf, or an adventure game, or a level-playing game for children. (Saari et al, 2005a)

3.3 Emotional Regulation Engine

Based on the Psychological Customization basic system design described above, we now present a possible system design for including emotional regulation into a gaming engine, in Figure 2. The process of a typical gaming engine is depicted on the left-hand side of the diagram. The engine continuously monitors user input, which is typically collected using a keyboard, a joystick, or other game controllers. This input data is then processed and transferred to the layer that handles the game's internal logical state, and the user input may influence the game state. After the logical state of the game is defined the system alters the actions of the synthetic agents in the game world. For example, these include the actions of computer-controlled non-player characters. The complexity of this AI layer varies greatly depending on the game. Based on the game state and the determined actions of the synthetic agents, the physics engine determines the kinetic movements of different objects within the world. Finally, the game world is synthesized for the player by rendering the graphical elements and producing and controlling the audio elements within the game. (Saari et al, 2005a)

The proposed emotional regulation can be implemented as a middleware system that runs parallel to the actual game engine. The input processing layer of the game engine can receive a data flow of captured and pre-processed sensor data. The real-time signal processing may consist of different forms of amplifying, filtering and feature selection on the biofeedback signals. This data flow may directly influence the state of the game world, or it can be used by the emotional regulation sub-module of the emotion feedback engine. This module consists of the rules of emotional balancing for different player profile types and gamer-related explicitly set preferences controlled by the "emotion knob". In addition, it contains a collection of design rules for narrative constructions and game object presentation within the game world. The emotional regulation module also receives input from the game engine's logical layer to make selections related to desired emotional balance and narrative structures within the game. (Saari et al, 2005a)

The outputs of emotional regulation engine may then be applied to various different levels of the actions of the game engine: i) the logical state of the world may be re-directed, ii) the actions of the synthetic agents may be controlled, iii) the kinetics of the game may be altered and iv) the rendering of the game world may be changed. First two options are more related to high-level and story-related structures of the game, whereas the last two are more directly related to the selection of presentation of objects within the virtual environment. (Saari et al, 2005a)

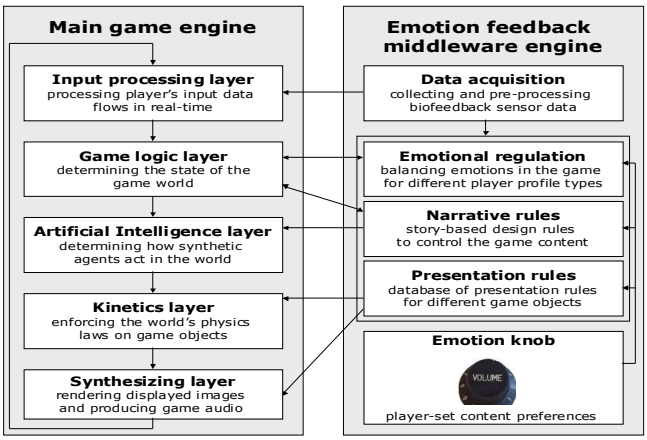

Figure 2. Emotion regulation engine for games. Adapted from Saari et al, 2005a.

4. Conclusion

Despite the promise of emotional regulation in games more empiric evidence is needed per selected focus area before conclusions can be provided. Yet, in our own research using psychophysiological measurements we have been able to achieve good results. It may indeed be possible to use phasic emotion-related psychophysiological responses as criterion variables in game design in several ways. From the perspective of emotion theory, one might predict that game events eliciting positive emotional responses are particularly effective in sustaining game playing, given that positive emotions serve as affective rewards for goal-directed behaviors. On the other hand, it is well known that people may enjoy seeing horror films that elicit fear, for example. Thus, also negative emotional responses may be desirable in some connections (see Ravaja, 2004). For many types of games, it is obvious that a good game should elicit both positive and negative emotional responses, at least to some extent. Future studies might examine whether it is possible to identify an optimal pattern of alternating positive and negative emotional responses.

Related to the approach of emotional regulation, however, the feasibility of an "Emotion Knob" for regulating one´s gaming experience has not been studied. It may be that dialing the Emotion Knob to high arousal already creates a psychological suggestion that will make the experience more intensive, or conversely it may even lead to disappointment if the experienced arousal level is lower than expected. Consequently, clear and conclusive hypothesis, best practices for design or other low-level and explicit recommendation on how exactly to build and best use a Psychological Customization system in pre-testing or building emotionally adapted games is beyond the scope of this conceptual paper.

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